(19) Patent Office, Japanese Government (JP)

(12) Laid Open Patent Gazette (A)

(11) Laid Open Patent Publication No.

Sho 63 / 1988- 273682

(51) Int. Cl.[4]	ID Symbol	Office File No.	(43) Date of Laid Open Publication
C 09 J 5 / 06	JGV	8016 - 4 J	November 10, 1988
E 04 F 13 / 08	101	K - 7130 - 2 E	

No. of Inventions 2

Request for Examination : yet to be submitted

(5 pages in all)

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(54) Title of the Invention Automatic Adhering Process and Adhesive Composite Material

(21) Patent Application No. Sho 62 / 1987- 108293

(22) Date of Application : April 30,1987

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SPECIFICATION

1. Title of the Invention

Automatic Adhering Process and Adhesive Composite Material

2. What we claim is :

1 An automatic adhering process characterized in that there is provided a magnetic flux generating coil (7) with respect to a moving means such as a manipulator which can be moved in the multi - axial directions, pre-determined electric power is supplied to the above - mentioned magnetic flux generating coil (7), thereby generating eddy current - generated heat in an electric conductive heat generating material layer (2) by the magnetic field, a heat sensitive adhesive resin layer (3) made of a synthetic resin which is co - present with the above - mentioned electric conductive heat generating material layer (2) is heated and thus members

to be adhered are adhered.

2 An adhesive composite material characterized in that there is provided an electric conductive heat generating material layer (2) such as a metal foil in a member to be adhered (1) such as a tile or one side thereof.

3. Detailed Explanation of the Invention

[Utilization Field in the Industry]

The present invention relates to an automatic adhering process developed to mechanically, safely and efficiently perform the adhesion of tiles, other floor materials, a wall material, a ceiling material, etc. to a wall surface or a floor surface, or furthermore, the manufacturing of a furniture product, and an adhesive composite material especially appropriate for use with this process.

[Conventional Technology]

Formerly, and conventionally, a floor material, a wall material, a ceiling material, etc. are coated mainly with an adhesive on the surface thereof, and then are adhered on the pre-determined position of a substrate

material. This operation has been usually carried out manually by an operator. And especially in a case of a ceiling surface and a wall surface, it takes a time for an adhesive to dry, and in order to fasten them on a temporarily basis, use has been made of pin- shaped nails, etc. In addition, in order to adhere ceramic tiles, etc. on a floor area or a wall area, use has been made of cement.

[Problem Points which The Invention is to Solve]

By the conventional techniques as mentioned above, the automation of operations (use of a robot) has been very difficult. In addition, extra work units, materials, etc. are required until an adhesive or cement becomes solidified, and these points have been a great bottle neck in the industries which have been greatly developed in the recent years by pursuing the rationalization. In addition, there has recently appeared a process which combines adhesive rubber and a tile, thereby eliminating a plastering work and shortening the construction time, and since there is a great merit in that a large area can be covered at once, attention has been paid to it, however, the problem here has been the development of a means by

which to complete the adhesion in a short period of time.

[Means by which to Solve the Problem Points]

As a result of carrying out various studies in order to solve the above - mentioned problem points, we have developed the automatic adhering process and the adhesive composite material appropriate for use in the process, in accordance with the present invention.

The automatic adhering process in accordance with the present invention is characterized in that there is provided a magnetic flux generating coil (7) with respect to a moving means such as a manipulator which can be moved in the multi - axial directions, pre- determined electric power is supplied to the above - mentioned magnetic flux generating coil (7), thereby generating eddy current - generated heat in an electric conductive heat generating material layer (2) by the magnetic field, a heat sensitive adhesive resin layer (3) made of a synthetic resin which is co - present with the above - mentioned electric conductive heat generating material layer (2) is heated and thus members to be adhered are adhered. And the adhesive composition material which is especially appropriate for used

with the process in accordance with the present invention is characterized in that there is provided an electric conductive heat generating material layer (2) such as a metal foil in a member to be adhered (1) such as a tile or one side thereof.

Here a moving means such as a manipulator means a means such as a manipulator, a running vehicle and a crane arm which has a function to move a magnetic flux generating coil (7) to a position required by an instruction from a computer or a wireless device, etc. In this case, movability in the multi - axial directions means that it is possible to an arbitrary required position along the 2 axes of X - Y or the 3 axes of X - Y - Z.

A magnetic flux generating coil means a coil which is capable of generating eddy current caused heat sufficient to increase the temperature of an electric conductive heating material to a level required when an electric current is provided in the magnetic flux generating coil. A frequency of approximately several to several 10 K Hz is appropriate.

An electric conductive heat generating material in the present invention

includes all types of electric conductive materials within a scope not to damage the heat generation by an eddy current loop. Not only a case in which an electric conductive heat generating material which forms a unitary body with an adhesive composite material forms a clear - cut layer but also a case in which by the addition of an electric conductivity - rendering material in a raw material adjusting stage or in a molding stage, it is enclosed or scattered in an organic or inorganic layer of an adhesive composite material is included.

With respect to the relation between an electric conductive heat generating material and a heating adhesive resin, it is permissible for them to be separate within a range which allows heat generation by an eddy current to be effectively given with respect to the heating adhesive resin. In a case in which other electric conductivity rendering material of a form such as a flake form, a fiber form and a layer form is contained, since the magnetic field energy renders directly heat energy to a heat adhesive resin, and the heating efficiency is good, and the present invention includes such a case.

In a case in which the electric conductive heat generating layer (2) is a metal foil, the sufficient thickness for the eddy current heat generation can be 50 μ or less. Even if the thickness is further increased, no change can be observed in heat generation, and it is just a waste.

To detect the presence or absence of an electric conductive heat generating material includes a case in which a metal sensor is equipped and an iron foil, etc. is detected, and here it indicates a case in which detection of a high frequency current value by allowing a current to flow through a coil is made by adopting an existing circuit which is utilized for the distinction of a load by means of an operational amplifier and a multi vibrator.

As to the configuration of an adhesive composite material, mention may be generally made of a tile, a floor material, a ceiling material, etc., which are to be attached to a wall surface or a floor surface, and they are characterized in that they are made as a unitary body with an adhesive heat generating material. Here unitary body means, for example, in a case of a ceramic title, molding by placing an electric conductive heat

generating material in a mold therewith at the time of molding before baking, or in a case of a synthetic resin wall material or floor material, embedding it in a synthetic resin in a melted state or matching it to the surface thereof. At this time, if an electric conductive heat generating material has a pierced hole / holes (4), it is possible to strengthen the unitary body.

On one of the surfaces of such an adhesive composite material is allowed to be present a synthetic resin which can be adhered by the heat generated by the electric conductive heat generating material layer (2). With respect to the synthetic resin here, in a case in which the substrate of an adhesive composite material is a synthetic resin itself, it is possible for the substrate itself to contribute to the fusing adhesion. In general, as such a synthetic resin, mention may be made of a hot melt type adhesive such as an EVA type and a poly amide type, or the one which performs the adhering function by the heating of a thermosetting adhesive medium.

Since the adhesive composite material in accordance with the present invention contains an electric conductive heat generating layer (2), if a

magnetic field is applied thereto, heat is generated, a heat adhesive layer (3) of a synthetic resin present in the neighborhood thereof is heated, and thus it assumes an adherable state. At that time, a moving means such as a movable manipulator which can move in the multi - axial (2 - axial or 3 - axial) directions has a function to move a magnetic flux generating coil (7) to the electric conductive heat generating material layer (2) and to cause heat to be generated if there is present an electric conductive heat generating material layer (2).

[Example Embodying the Present Invention]

In the following, we shall explain some examples embodying the invention in a specific manner by referring to the drawings.

Fig. 1 is a partially broken obliquely seen view which shows one example of an adhesive composite material in accordance with the present invention, and Fig. 2 is a vertical cross sectional view which shows the major section thereof. Fig. 3 and Fig. 4 are drawings corresponding to Fig. 2 which show other examples embodying the invention. Fig. 5 is a vertical cross sectional view which shows the state in which an adhesive

composite material in accordance with the present invention is being attached to a base material by melting by means of an induction heating means. Fig. 6 is a front view thereof.

The automatic adhering process in accordance with the present invention will be explained in detail by referring to the drawings later, and is characterized in that there is provided a magnetic flux generating coil (7) with respect to a moving means such as a manipulator which can be moved in the multi - axial directions, the presence or absence of an electric conductive heat generating material layer (2) is detected by allowing a current to flow through this magnetic flux generating coil (7), pre- determined electric power is supplied to the above - mentioned magnetic flux generating coil (7), thereby generating eddy current - generated heat in an electric conductive heat generating material layer (2) by the magnetic field, a heat sensitive adhesive resin layer (3) made of a synthetic resin which is co - present with the above - mentioned electric conductive heat generating material layer (2) is heated and thus members to be adhered are adhered. Here with respect to an especially preferable

adhesive composite material for use with the process in accordance with the present invention, we shall give an explanation by referring to the drawings below.

The adhesive composite material (10) to be used in the automatic adhering process in accordance with the present invention is characterized in that there is provided an electric conductive heat generating material layer (2) such as a metal foil in a member to be adhered (1) such as a tile or one side thereof, and with the example shown in the drawing, a porcelain tile is a member to be adhered (1), and it is viewed from the surface side. In this case, on the back face of a member to be adhered (1) is provided an electric conductive heat generating material layer (2) of iron flakes (25 μ) which generates heat by an eddy current, and a large number of pierced holes (4) are drilled on this heat generating material layer (2) with a certain interval. And there is provided a heat sensitive adhesive resin layer (3) which covers the whole surface of the electric conductive heat generating material layer (2). This heat sensitive adhesive resin layer (3) is a poly amide series hot melt

adhesive (nylon 12 : trade name, Diamide).

As shown in Fig. 5 and Fig. 6, if the adhesive composite material (10) is placed on the base material (5) such as a wall face, a current is allowed to flow through an induction heating device (6) containing a magnetic flux generating coil (7) from the upper side thereof, and it is brought to the neighborhood of, or into contact with, this adhesive composite material (10), the electric conductive heat generating material layer (2) is heated by the eddy current caused by the magnetic field. When the electric conductive heat generating material layer (2) is heated in this manner, the heat sensitive adhesive resin layer (3) which is co -present therewith is heated and fused, and the base material (5) and the member to be adhered (1) are adhered to each other.

The adhesive composite material (10) shown in Fig. 3 is of a configuration in which the electric conductive heat generating material layer (2) does not have any pierced hole (4) in the above - mentioned example embodying the invention. In addition, with the example embodying the invention shown in Fig. 4, the electric conductive heat

generating material layer (2) having pierced holes (4) is provided as the same layer as the heat sensitive adhesive resin layer (3) on the surface of the member to be adhered (1).

The moving means explained so far is an example of a manipulator (8) shown in Fig. 5. With respect to the rightward or leftward or upward or downward movements of the manipulator (including a crane arm, etc.) (8), use can be made of technology known in the art such as a motor drive, a cylinder, and furthermore use of a shape memory alloy, etc. The drive instructions to each of these elements are given by a computer generally used for such a manipulator and a running vehicle. Here the instruction which has not been seen with a conventional case is to reflect the result of the detection of the presence or absence of the electric conductive heat generating material on the rightward or leftward or upward or downward movements of the manipulator in a case in which the electric conductive heat generating material layer (2) is randomly searched. In a case in which a magnetic field is applied in a sequential order, a movement position is stored in a computer in advance, and the

position is changed in sequence according to it.

In a case in which a moving means is a running vehicle which has wheels differing from a manipulator, the detection and search are made by a random or sequential run in a similar manner. In a case of such a running vehicle, it is possible to move it on a floor surface by a conventional wireless device known in the art. Fig. 7 is a vertical cross sectional view which shows the state in which the automatic adhering process in accordance with the present invention is being carried out by use of a running vehicle (9). On the bottom section floor of the running vehicle (9) is provided a magnetic flux generating coil (7) as shown in Fig. 7, and as it runs, heating of an electric conductive heat generating material layer (2) as described so far is carried out.

As can be seen from what has been explained above, to provide a magnetic flux generating coil (7) to a moving means is not limited to providing only a coil (7) but includes, in terms of designing, providing a control section and a power source at the same time by which to supply an electric current to the coil (7).

The current supply quantity to the magnetic flux generating coil (7) varies depending on the heat required for adhesion of the heat sensitive adhesive resin layer (3), the heat generated by the eddy current of the electric conductive heat generating material layer (2), the heat capacity of a member to be adhered, etc., however, adhesion becomes possible with a power quantity of about 100 to 3500 W. Fig. 8 is a flow sheet which shows the operations carried out by a moving means in the present invention, and the current control example at the time of the generation of a magnetic flux in the coil (7). This shows the movement of a coil (7) by means of a moving means such as a manipulator, etc., and the search and detection of the presence of an electric conductive heat generating material layer (2) by that, and, in a case in which it is present, the fact that an eddy current loss is detected, it moves to the electric conductive heat generating material layer (2), stops there, or a magnetic field is given while moving. In a case in which a thermal adhesion region is set in advance, while detecting an electric conductive heat generating material in that region, a magnetic field energy is given, and as a result, heating is

done. The selection for the sequential or random moving depends on how the movement into the pre- determined direction at the upper most section of the flow sheet is set. The present invention is characterized in that a magnetic field acted by the moving means generates heat in the electric conductive heat generating material layer (2), and as a result, the heat sensitive adhesive resin layer (3) becomes adherable, and the object of adhesion is thus achieved. Here we shall omit (describing) the detailed program by which to instruct the devices.

As mentioned above, by the automatic adhering process in accordance with the present invention, it is characterized in that it is possible to adhere a decorative plate or a tile by an adhesive located at a place not seen by people, and it is possible to peel off it by use of a magnetic field.

[Effects of the Invention]

As can be clearly seen from what has been explained above, with the automatic adhering process and the adhesive composite material in accordance with the present invention, since it has become possible to do the works of attaching tiles, etc. to a wall surface or floor surface by

means of a machine instead of manual operations, we have obtained effects contributing greatly to labor saving, and simplification of adhering operations.

4. Simple Explanation of the Drawings

Fig. 1 is a partially broken obliquely seen view which shows one example of an adhesive composite material in accordance with the present invention, and Fig. 2 is a vertical cross sectional view which shows the major section thereof. Fig. 3 and Fig. 4 are drawings corresponding to Fig. 2 which show other examples embodying the invention. Fig. 5 is a vertical cross sectional view which shows the state in which an adhesive composite material in accordance with the present invention is being attached to a base material by melting by means of an induction heating means. Fig. 6 is a front view thereof. Fig. 7 is a vertical cross sectional view which shows the state in which the automatic adhering process in accordance with the present invention is being carried out by use of a running vehicle. Fig. 8 is a flow sheet which shows the operations carried

out by a moving means in the present invention, and (illegible).

(1) is a member to be adhered, (2) is an electric conductive heat generating material layer, (3) is a heat sensitive adhering resin layer, (4) is a pierced hole, (5) is a base material, (6) is an induction heating device, (7) is a magnetic flux generating coil, (8) is a manipulator, (9) is a running vehicle, and (10) is an adhesive composite material.

Patent Applicant : R. Miyamoto

Fig. 1

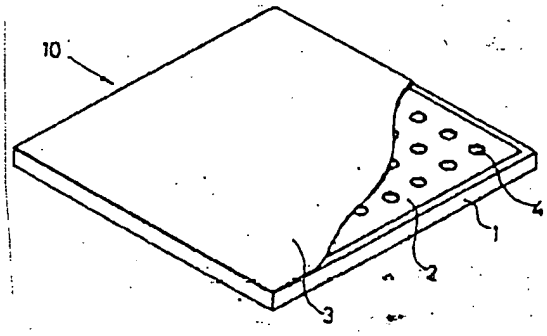


Fig. 2

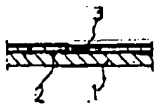


Fig. 3

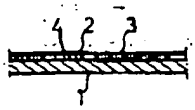


Fig. 4

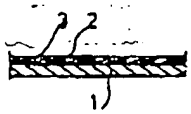


Fig. 5

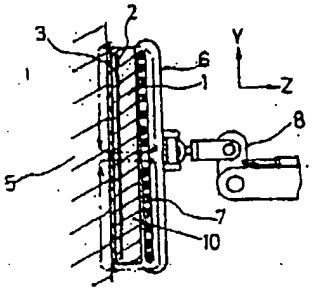


Fig. 6

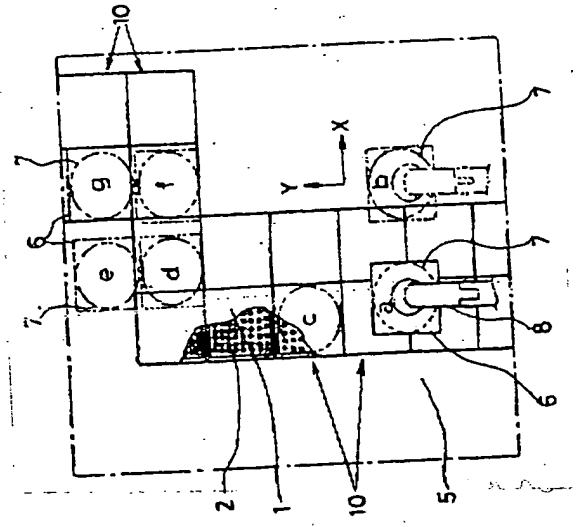


Fig. 7

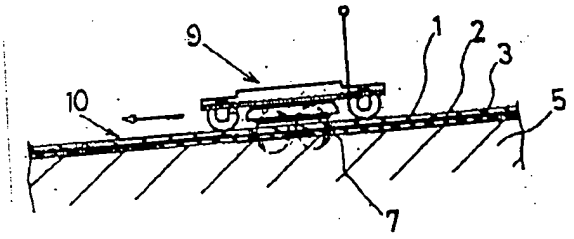
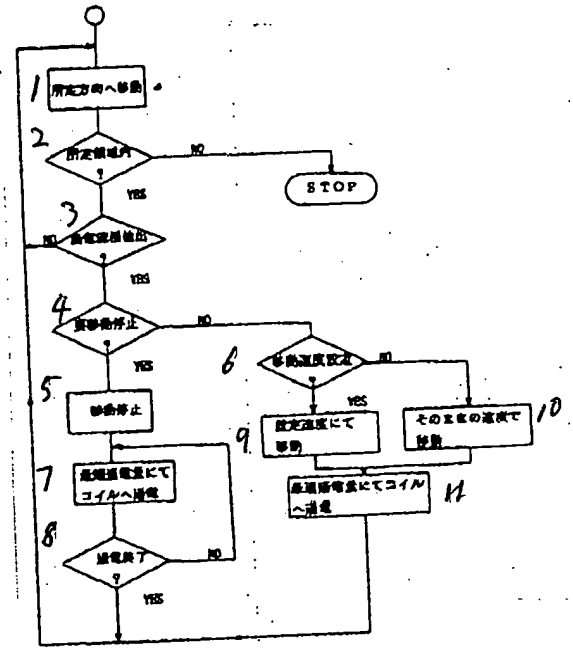


Fig. 8



key 1 movement into a pre- determined direction, 2 within a pre-determined region, 3 detection of eddy current loss, 4 stoppage of movement required ? 5 stop of movement, 6 moving speed set, 7 current of an optimum current volume supplied to coil, 8 end of current supply, 9 moving at the set speed, 10 moving at that speed, 11 current of an optimum current volume supplied to coil